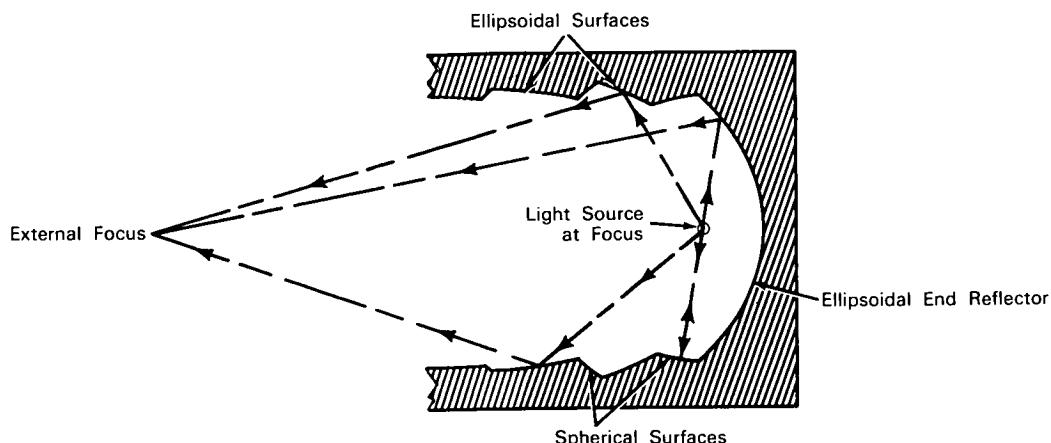


# NASA TECH BRIEF



This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the NASA space program.

## Fresnel Cup Reflector Directs Maximum Energy from Light Source



**The problem:** In many optical systems it is necessary to direct the maximum amount of energy from an omnidirectional light source to a focus or in a parallel beam. A primary ellipsoidal or paraboloidal reflector is ordinarily used to direct the light. To achieve the desired directivity with as small a primary reflector as possible, a small spherical reflector cup is often positioned axially in front of the light source in the primary reflector. Auxiliary cups, however, shield some of the light returned from the primary reflector; when a cup of proper aperture is placed very close to the light source to minimize this shielding, the cup may become overheated.

**The solution:** A composite reflector consisting of a uniformly ellipsoidal end surface and an extension comprising a series of confocal ellipsoidal surfaces and a series of concentric spherical surfaces. The composite reflector directs a maximum amount of energy for its size, yet avoids the problems inherent in using an auxiliary cup reflector.

**How it's done:** The composite ellipsoidal reflector is shown in the cross-sectional drawing. In this reflector, the ellipsoidal end surface and the ellipsoidal surfaces in the extension have common foci. Each of the spherical reflecting surfaces in the extension is concentric about the internal focus (where the light is placed) of the ellipsoidal surfaces. An appropriate reflecting material such as vapor-deposited aluminum is used to coat the inside surfaces of the reflector.

All rays of light emanating from the source and falling on the ellipsoidal surfaces of the reflector are reflected directly to the external focus. All rays of light from the light source incident on any of the spherical surfaces of the reflector are reflected back through the source to the ellipsoidal end surface, as though they came directly from the light source.

### Notes:

1. If light is to be directed in parallel rays instead of being focused, the ellipsoidal reflecting end and rings must be replaced by confocal paraboloidal surfaces.

(continued overleaf)

2. An important parameter to consider in the design of the reflector is the location of the light source on the axis of symmetry.
3. For further information about this innovation inquiries may be directed to:

Technology Utilization Officer  
Jet Propulsion Laboratory  
4800 Oak Grove Drive  
Pasadena, California 91103  
Reference: B63-10263

**Patent status:** NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA Headquarters, Washington, D.C. 20546.

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(JPL-424)